



MU123

Practice quizzes for Units 11 to 14 (Set 2)

Note that the questions in this document are designed for on screen usage via the course website. Some of the instructions within questions may not quite suit this printed version, e.g. when the question refers to 'box below' this should be interpreted as 'box in margin'.

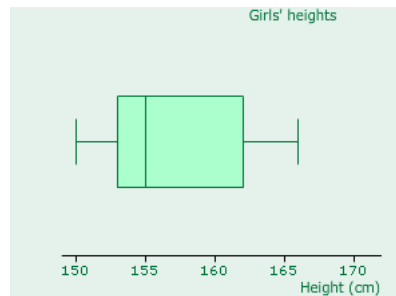
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Unit 11 practice quiz questions

Question 1

The following boxplots represent the heights, in cm, of 13 boys and 7 girls aged from 11 to 14 years.



Choose the **two** options from the list below that are true.

Options

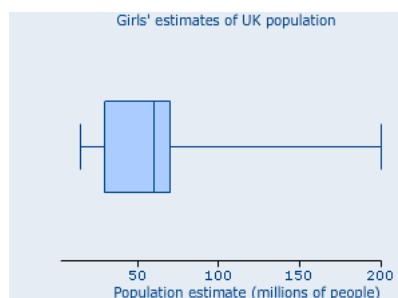
- A** The interquartile range of the girls' heights is smaller than the interquartile range of the boys' heights.
- B** The range of the boys' heights is less than the interquartile range of the girls' heights.
- C** The range of the girls' heights is greater than the range of the boys' heights.
- D** All the girls' heights are greater than the bottom 25% of the boys' heights.
- E** The median of the girls' heights is less than the median of the boys' heights.
- F** The median of the boys' heights is less than the first quartile of the girls' heights.

Answer:

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Question 2

The following boxplot was drawn from data giving the estimates of the size of the UK population provided by thirteen 14 and 15 year old females.



Choose the **one** option from the list below that is true.

Options

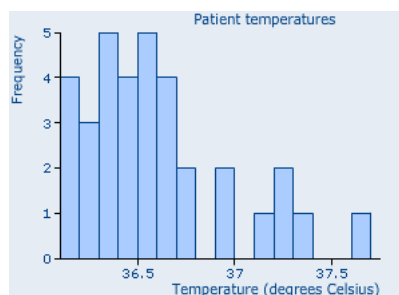
- A** The range is smaller than the interquartile range.
- B** The median is smaller than the lower quartile.
- C** The median is smaller than the upper quartile.
- D** The median is closer to the lower quartile than the upper quartile.

Answer:

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Question 3

The following histogram represents the distribution of the body temperatures (in degrees Celsius) of 34 hospital patients.



Choose the **two** options from the list below that are true.

Options

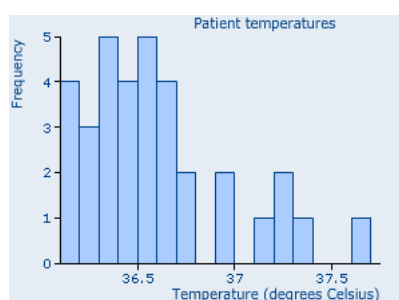
- A** Exactly six patients had temperatures 37 degrees Celsius or greater.
- B** The three columns with the lowest frequencies together contain a total of three data values.
- C** There are exactly sixteen patients with temperatures less than 36.5 degrees Celsius.
- D** There are exactly two intervals in the histogram which contain exactly two data values.
- E** The range of the data values is less than 1.3 degrees Celsius.
- F** The data values are more concentrated in the middle of the histogram than at the extremes.

Answer:

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Question 4

The following histogram represents the distribution of the body temperatures of 20 hospital patients.



Answer:

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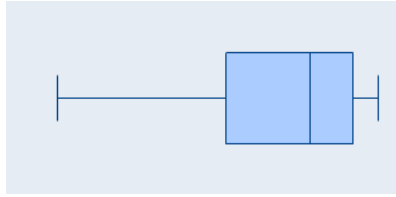
How many patients had temperatures greater than or equal to 36.6 but less than 37 degrees Celsius?

(Your answer should be a number.)

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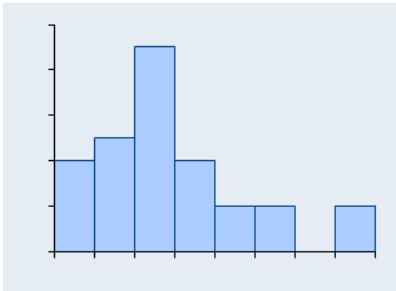
Question 5

Which of the following histograms could represent the same dataset as the boxplot shown below?

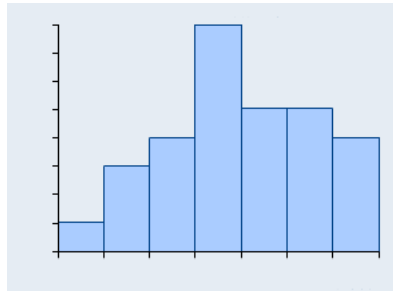


Options

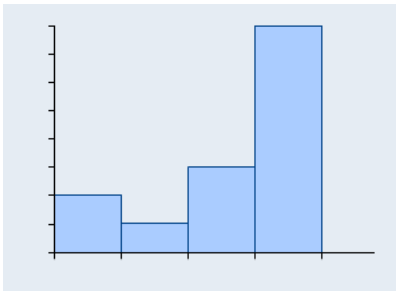
A



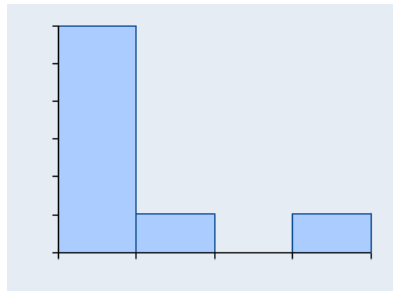
B



C



D



Answer:

Question 6

Consider the following random numbers.

Which number has the highest frequency?

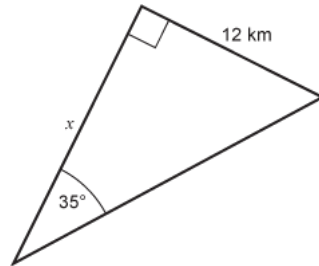
2 8 8 8 3 8 1 4 4 7 0 1 8 4 7

Answer:

Unit 12 practice quiz questions

Question 1

Calculate the length marked x in the following diagram.



Answer:

Enter your answer in kilometres to one decimal place in the box below (without units).

Question 2

The point B is 5 cm in a direction 80° east of south from point A .

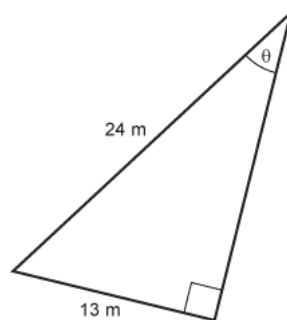
How many centimetres south is point B from point A ?

Enter your answer in centimetres to one decimal place in the box below (without units).

Answer:

Question 3

Calculate the angle marked θ in the following diagram.

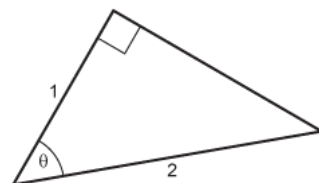


Answer:

Enter your answer in degrees to the nearest degree in the box below (without units).

Question 4

Consider the following triangle (not drawn to scale).



Select the option that is the value of the angle marked θ .

(Hint: you should not need to calculate anything as the given triangle is one of the standard triangles used to calculate useful known values of sine, cosine and tangent.)

Options

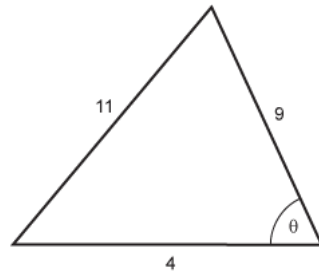
A 30° B 60° C 0° D 90° E 45°

Answer:

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Question 5

Calculate the angle marked θ in the following triangle (this triangle has purposely not been drawn to scale).



Answer:

Enter your answer in degrees to the nearest degree in the box below (without units).

Question 6

Select the option that is the quadrant containing the angle 290° .

Options

- A first B second C third D fourth

Answer:

Question 7

By plotting the appropriate point P on the unit circle and using a suitable right-angled triangle, select the option that is equal to $\cos 290^\circ$.

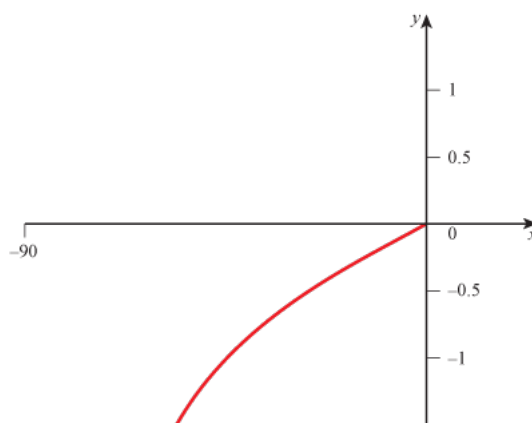
Options

- A $\tan 20^\circ$ B $\cos 20^\circ$ C $\sin 20^\circ$ D $-\sin 20^\circ$ E $-\cos 20^\circ$

Answer:

Question 8

Select the option that could be the function plotted in the following graph.



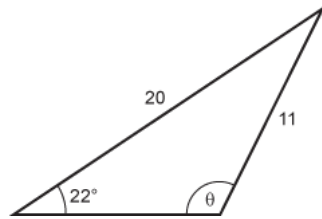
Options

- A cosine B tangent C sine

Answer:

Question 9

Calculate the obtuse angle marked θ in the following triangle (this triangle has purposely not been drawn to scale).



Enter your answer in degrees to the nearest degree in the box below (without units).

Answer:

Question 10

Convert $\frac{10}{9}\pi$ radians to degrees.

Enter your answer in degrees to the nearest degree in the box below (without units).

Answer:

Question 11

Calculate the area of a sector of a circle of radius 5 with angle subtended equal to $\pi/6$ radians.

Enter your answer in the box below to two significant figures.

Answer:

Question 12

Consider a point Q a distance of one unit along the positive x -axis from the origin O .

Consider plotting a point P on a unit circle that corresponds to rotating the point Q by an angle 320° about the point O .

Select the option that gives an angle in radians that would also rotate the point Q to the point P .

Options

- A $\frac{8}{9}\pi$ B $-\frac{2}{9}\pi$ C $-\frac{32}{9}\pi$ D $\frac{2}{9}\pi$ E $-\frac{8}{9}\pi$

Answer:

Unit 13 practice quiz questions

Question 1

A certain micro-organism doubles in number every fifteen minutes. If there is one organism to begin with, how many will there be 6 hours later?

Options

- A** 2×10^7 (approximately) **B** 8×10^6 (approximately)
C 24 **D** 2×10^8 (approximately)
E 48

Answer:

Question 2

Choose the correct option from the drop down list for each of the statements below:

The price of a computer is increased by 45%. To calculate the new price you would need to

The price of a coat is discounted by 45%. To calculate the new price you would need to

The price of a chair is increased by 45%. To calculate the amount of the increase you would need to

Options

- A** divide the old price by 0.55 **B** divide the old price by 0.45
C multiply the old price by 0.55 **D** multiply the old price by 1.45
E multiply the old price by 0.45 **F** divide the old price by 1.45

Question 3

A personal computer initially costs £900, and its value depreciates at a rate of 32% per year.

What is its value after 3 years, to the nearest £100?

(Give your answer as a number, without units.)

Answer:

Question 4

A handmade acoustic guitar costs £1200 and will increase in value with age at a fixed rate of 2.8 percent per year. Assuming there is no damage to the instrument in that period, by how much will the value of the guitar have increased after 10 years (to the nearest £1)?

(Give your answer as a number, without units.)

Answer:

Question 5

Six-year old Carrie's grandparents generously offered to help with her future university fees, by investing in a savings plan with a rate of interest of 6.2 percent per year. How much money (to the nearest £1) would need to be invested to give a total amount of £25000 in 12 years time?

(Give your answer as a number, without units.)

Answer:

Question 6

Drag the words below to correctly complete the following sentence.

A function of the form $y = b^x$ is called . Such functions can be either discrete or . While graphs of continuous exponential functions are smooth in shape, if the data from the chessboard problem of Unit 13, Subsection 1.1, where the number of grains of rice is doubled for each square on the chessboard, were plotted, the shape of the exponential graph would be a series of points.

Options for all boxes

- A exponential B continuous C unconnected D smooth
E discrete F doubling

Answer:

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Question 7

A bank is advertising a loan which has an interest rate of 1.5%, charged every month.

What is the annual percentage rate (APR), to two decimal places?

(Give your answer as a number, without the percentage symbol (%).)

Answer:

Question 8

This question concerns the graph of the equation

$$y = ab^x + c,$$

where x and y are variables and a , b and c can be given any numerical value.

Which **one** of the following statements is **true**?

Options

- A Setting $a = 0$, $b = 0$ and $c = 0$ causes the equation and its graph to disappear.
B It is possible to find values for a and b which would turn the equation into a quadratic equation.
C Setting $c = 0$ gives a horizontal straight line $y = ab$.
D Setting $a = 1$, $b = 2$ gives a graph with the line $y = c$ as an asymptote.
E Setting $b = 0$ gives a horizontal straight line $y = a + c$.

Answer:

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Question 9

Between which two adjacent integers is the numerical value of $\log_{10}(18.94)$?

Options

- A 3 to 4 B -3 to -2 C -4 to -3 D 1 to 2
E 2 to 3 F -1 to 0 G 0 to 1 H -2 to -1

Answer:

Question 10

What is the value of $\log_3(81)$?

(Give your answer as a number.)

Answer:

Question 11

Use the laws of logarithms to find the value of x such that

$$\log_3 x = 4\log_3 6 - 3\log_3 3 + 2\log_3 5$$

and enter the appropriate value of x in the box below.

(Your answer should be a number.)

Answer:

Question 12

Solve the following equation for x , giving your answer correct to two decimal places.

$$5^x = 11.$$

(Give your answer as a number.)

Answer:

Question 13

The radioactivity levels of a sample of selenium-75 has been measured and found to be decreasing by 0.58% each day.

What is the half-life of selenium-75?

Give your answer in days, correct to one decimal place (without units).

Answer:

Question 14

The radioactive half-life of zinc-69 is 57 minutes.

The radioactivity levels of a sample of zinc-69 has been measured to be 12 becquerels.

What will the radioactivity level be 100 minutes later, to the nearest becquerel?

(Give your answer as a number, without units.)

Answer:

Unit 14 practice quiz questions

Question 1

In a town, it is estimated that '1 in 13' households do not have internet access.

What is the chance that a household selected at random does not have internet access?

Enter your answer as a decimal, rounded to 2 significant figures, in the box below.

Answer:

Question 2

Solve the following simultaneous equations:

$$\begin{aligned}y &= 5x + 10 \\ y &= x^2 - 10x - 6\end{aligned}$$

Choose the two correct options for y .

Options

- A** 90 **B** 16 **C** 15 **D** -1
E -70 **F** 5 **G** -30 **H** -15

Answer:

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Question 3

Select the angle between 0 and 2π that has the same cosine as the angle $\frac{13\pi}{7}$.

Options

- A** $\frac{20\pi}{7}$ **B** $\frac{-5\pi}{14}$ **C** $\frac{-6\pi}{7}$ **D** $\frac{33\pi}{14}$ **E** $\frac{\pi}{7}$

Answer:

Question 4

Calculate the largest angle θ between 0 and 2π for which

$$\sin \theta = 0.69.$$

Enter the largest angle in radians, rounded to three significant figures, in the box below.

(Your answer should be a number, without units.)

Answer:

Question 5

Calculate to the nearest degree the largest angle θ between 0° and 360° for which

$$\cos \theta = -0.596.$$

Round your answer to the nearest degree and enter this rounded answer in the box below.

(Your answer should be a number, without a degree symbol.)

Answer:

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Question 6

What is the angle of inclination of the line given by the following equation?

$$y = \frac{6}{7}x + 6$$

Enter your answer rounded to the nearest degree in the box below.

(Your answer should be a number, without a degree symbol.)

Answer:

Question 7

Select the option that gives the period of the graph of

$$y = \sin\left(8x - \frac{\pi}{3}\right) - 2$$

Options

- A 8 B $\frac{\pi}{16}$ C $\frac{\pi}{3}$ D $\frac{\pi}{8}$ E $\frac{\pi}{4}$

Answer:

Question 8

Select the two options which are correct statements about the equation

$$y = 7 \sin\left(5x + \frac{\pi}{3}\right) - 5$$

Options

- A The minimum value of the function is -12 .
B The amplitude is 14 .
C The graph of $y = 7 \sin\left(5x + \frac{\pi}{3}\right) - 5$ can be obtained by shifting the graph of $y = 7 \sin(5x) - 5$ by $\frac{\pi}{3}$ units to the left.
D The vertical displacement is 2 .
E The minimum value of the function is -5 .
F The graph of $y = 7 \sin\left(5x + \frac{\pi}{3}\right) - 5$ can be obtained by shifting the graph of $y = 7 \sin(5x) - 5$ by $\frac{\pi}{15}$ units to the left.

Answer:

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Unit 11 practice quiz solutions

Solution 1

Correct option : ☐ A

Correct option : ☐ E

The correct options are:

- The median of the girls' heights is less than the median of the boys' heights.
The median is represented by the line in the middle of the box. This is 155 cm for the girls and 161 cm for the boys. The median of the girls' heights is therefore the smaller.
- The interquartile range of the girls' heights is smaller than the interquartile range of the boys' heights.
The interquartile range is indicated by the length of the central box. This is greater for the boys' data than the girls'.

See Unit 11, Subsection 1.2.

Solution 2

Correct option : ☐ C

The correct option is:

- The median is smaller than the upper quartile.
The median is represented on the boxplot by the line within the box. The upper quartile is represented by the right-hand edge of the box. The median is always less than (or equal to) the upper quartile.

See Unit 11, Subsection 1.2.

Solution 3

Correct option : ☐ B

Correct option : ☐ C

The correct options are:

- The three columns with the lowest frequencies together contain a total of three data values.
The three columns with the lowest frequencies are the three shortest columns. In this case the shortest columns are those from 37.1 up to 37.2 degrees Celsius, from 37.3 up to 37.4 degrees Celsius and from 37.6 up to 37.7 degrees Celsius, each of which contains one data value. Adding the numbers of data values in these columns gives three data values.
- There are exactly sixteen patients with temperatures less than 36.5 degrees Celsius.
The number of patients with temperatures less than 36.5 degrees Celsius is given by the sum of the heights of the corresponding columns. The columns representing patients with temperatures less than 36.5 degrees Celsius are those from 36.1 up to 36.2 degrees Celsius (which contains four data values), from 36.2 up to 36.3 degrees Celsius (which contains three data values), from 36.3 up to 36.4 degrees Celsius (which contains five data values) and from 36.4 up to 36.5 degrees Celsius (which contains four data values). So, the

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total number of values within the columns representing patients with temperatures less than 36.5 degrees Celsius is sixteen.

See Unit 11, Section 2.

Solution 4

Correct answer :

In a histogram, the number of values occurring in each interval is represented by the height of the corresponding column.

The number of patients who had temperatures greater than or equal to 36.6 but less than 37 degrees Celsius can be found by totalling the heights of the columns corresponding to this. The column corresponding to 36.6 up to 36.7 degrees Celsius has a height of 4, that corresponding to 36.7 up to 36.8 degrees Celsius has a height of 2 and that corresponding to 36.9 up to 37 degrees Celsius has a height of 2

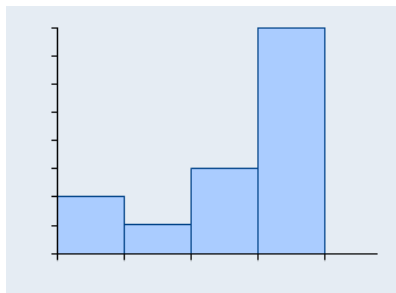
So, the number of patients who had temperatures greater than or equal to 36.6 but less than 37 degrees Celsius is $4 + 2 + 2 = 8$.

See Unit 11, Section 2.

Solution 5

Correct option :

The correct histogram corresponding to the given boxplot is show below.



The boxplot is divided into four quartiles each containing 25% of the data values. The distance from the lower quartile to the maximum is shorter than the left-hand whisker. This indicates that approx 75% of the data values are concentrated on the right-hand side of the histogram. The length of the right-hand whisker tells you that the highest concentration is on the extreme right-hand side of the histogram.

See Unit 11, Sections 1 and 2.

Solution 6

Correct answer :

By counting the occurrence of each number, or by plotting the data using Dataplotter, the number occurring most often is 8 which occurs five times.

See Unit 11, Subsection 3.2.

Unit 12 practice quiz solutions

Solution 1

Correct answer : 17.1

From the diagram we see that in the right-angled triangle we are given the opposite side as 12 km and the required distance x is the adjacent side to the given angle. So, remembering SOH CAH TOA, the trigonometric ratio to use is tangent.

So we have

$$\tan 35^\circ = \frac{12}{x}$$

Re-arranging to make x the subject gives

$$x = \frac{12}{\tan 35^\circ}$$

Using a calculator gives $x = 17.1$ to two significant figures.

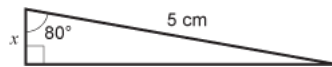
So the required answer is 17.1.

See Unit 12, Subsection 1.2.

Solution 2

Correct answer : 0.9

Start by drawing a diagram.



From the diagram we see that in the right-angled triangle we are given the hypotenuse 5 cm and the required distance is the side adjacent to the given angle. So, remembering SOH CAH TOA, the trigonometric ratio to use is cosine.

So we have

$$\cos 80^\circ = \frac{x}{5}$$

Multiplying by 5 to make x the subject gives

$$5 \cos 80^\circ = x$$

Using a calculator gives $x = 0.9$ to one decimal place.

So the required answer is 0.9.

See Unit 12, Subsection 1.2.

Solution 3

Correct answer : 33

From the diagram we see that in the right-angled triangle with respect to the required angle θ we are given the hypotenuse as 24 m and the opposite side as 13 m. So, remembering SOH CAH TOA, the trigonometric ratio to use is sine.

So we have

$$\sin \theta = \frac{13}{24}$$

Taking then inverse sine of both sides gives

$$\theta = \sin^{-1} \left(\frac{13}{24} \right)$$

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Using a calculator gives $\theta = 33^\circ$ to the nearest degree.

So the required answer is 33.

See Unit 12, Subsection 1.3.

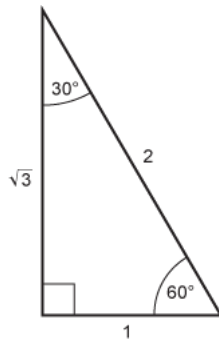
Solution 4

Correct option : B

As the hint says the triangle is one of the triangles related to the useful known values of sine, cosine and tangent.

From the given information you should be able to recognise that the triangle as half of an equilateral triangle with sides of length two split by a line from a vertex to the middle of the opposite side.

The full labelling of this triangle is as follows



Comparing the given triangle with the above triangle gives $\theta = 60^\circ$.

See Unit 12, Subsection 1.4.

Solution 5

Correct answer : 109

This triangle has all three sides given and does not contain right angle, so the method to use is the cosine rule:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

In this formula the angle A is opposite the side a . So in the diagram if the angle A is θ then the side a is 11. The sides b and c are the other two sides, i.e. 4 and 9. Substituting these values into the above formula gives:

$$11^2 = 4^2 + 9^2 - 2 \times 4 \times 9 \times \cos \theta$$

This evaluates to

$$24 = -72 \times \cos \theta$$

So

$$\cos \theta = -0.333333 \dots$$

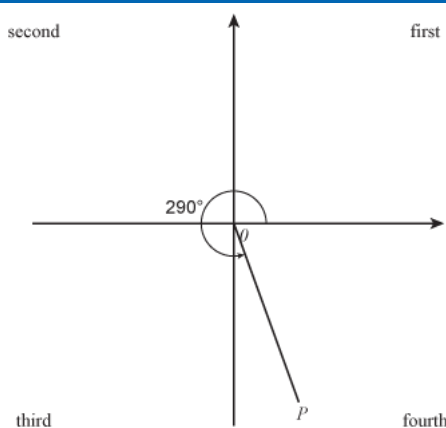
Taking the inverse cosine of both sides gives $\theta = 109^\circ$ to the nearest degree.

See Unit 12, Subsection 2.2.

Solution 6

Correct option : C

The first step is to draw a diagram.



From the diagram it can be seen that the angle is in the fourth quadrant.

See Unit 12, Subsection 3.1.

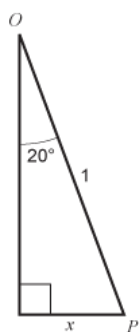
Solution 7

Correct option : C

The first step is to draw a diagram. The angle 290° lies in the fourth quadrant, so the corresponding acute angle is:

$$290^\circ - 270^\circ = 20^\circ$$

A diagram with the point P marked is as follows.



The length x marked in the diagram is the magnitude of the cosine of 290° . In the acute angled triangle shown the length x is opposite the acute angle 20° , so $\cos 290^\circ$ is related to the sine of 20° .

The point P is in the fourth quadrant so $\cos 290^\circ$ must be positive.

Putting these two facts together gives the answer

$$\cos 290^\circ = \sin 20^\circ$$

See Unit 12, Subsection 3.1.

Solution 8

Correct option : B

Looking at the origin we see that the value of the function is $y = 0$ at $x = 0$. So of the three options the function must be sine or tangent. Furthermore, the graph has values less than -1 and greater than 1 so the function must be tangent.

So the answer is tangent.

See Unit 12, Subsection 3.2.

Solution 9Correct answer : 137

The triangle has an angle together with the opposite side length given, so it is easiest to use the Sine Rule:

$$\frac{11}{\sin 22^\circ} = \frac{20}{\sin \theta}$$

Rearranging to make $\sin \theta$ the subject gives

$$\begin{aligned}\sin \theta &= \frac{20 \sin 22^\circ}{11} \\ &= 0.681102 \dots\end{aligned}$$

Using a calculator to calculate the inverse sine of both sides gives $\theta = 43^\circ$ to the nearest degree.

However the required angle is an obtuse angle with the same sine, which is calculated as $180^\circ - 43^\circ = 137^\circ$.

So the required answer is 137.

See Unit 12, Subsection 3.3.

Solution 10Correct answer : 200

The conversion factor is $180/\pi$ so the angle in degrees is

$$\begin{aligned}\frac{10}{9}\pi \times \frac{180}{\pi} &= \frac{10 \times 180}{9} \\ &= 200\end{aligned}$$

So the required angle is 200° .

See Unit 12, Subsection 4.1.

Solution 11Correct answer : 6.5

The formula for the area of a sector of a circle of radius r that subtends an angle of θ radians is $\frac{1}{2}r^2\theta$.

The given data is that $r = 5$ and $\theta = \pi/6$, so the area of the sector is

$$\begin{aligned}\frac{1}{2}r^2\theta &= \frac{1}{2} \times 5^2 \times \frac{\pi}{6} \\ &= 6.54498 \dots\end{aligned}$$

So the required area is 6.5 to two significant figures.

See Unit 12, Subsection 4.2.

Solution 12Correct option : B

The conversion factor from degrees to radians is $\pi/180$, which gives

$$\begin{aligned}\text{angle in radians} &= \frac{\pi}{180} \times 320 \\ &= \frac{16}{9}\pi\end{aligned}$$

This value is an angle in radians that would move the point Q to the point P , but it is not in the given options.

Now remember that rotating through a full circle does not change the final position of the point P .

Going anticlockwise around the circle once corresponds to adding 2π radians.

Adding 2π gives $\frac{34}{9}\pi$, which is also not in the given options.

Going clockwise around the circle once corresponds to subtracting 2π radians.

Subtracting 2π gives $-\frac{2}{9}\pi$, which is in the given options and so is the required answer.

See Unit 12, Subsection 4.1.

Unit 13 practice quiz solutions

Solution 1

Correct option : A

The number of organisms doubles every fifteen minutes.

In 6 hours there are 24 doublings.

After the first doubling there will be 2 organisms.

After the second doubling there will be $2 \times 2 = 2^2 = 4$ organisms.

After the third doubling there will be $2 \times 2 \times 2 = 2^3 = 8$ organisms.

Continuing this pattern, after 24 doublings there will be $2^{24} = 1.68 \times 10^7$ organisms (to 3 s.f.).

The required answer is thus 2×10^7 (approximately).

See Unit 13, Subsection 1.1.

Solution 2

Matching pairs:

The price of a computer is increased by 45%. To calculate the new price you would need to	multiply the old price by 1.45
The price of a coat is discounted by 45%. To calculate the new price you would need to	multiply the old price by 0.55
The price of a chair is increased by 45%. To calculate the amount of the increase you would need to	multiply the old price by 0.45

- If the price of the computer increases by 45%, the new price can be found from the old by multiplying by a scale factor of $\frac{100+45}{100} = 1 + \frac{45}{100} = 1.45$.
- If the price of the coat decreases by 45%, the new price can be found from the old by multiplying by a scale factor of $\frac{100-45}{100} = 1 - \frac{45}{100} = 0.55$.
- If the price of the chair increases by 45%, the increase in price is 45% of the original price, which can be found by multiplying the original price by $\frac{45}{100} = 0.45$.

See Unit 13, Subsection 1.2.

Solution 3

Correct answer : 300

The value decreases by 32% each year, so at the end of a year it is only worth $(100 - 32)\% = 68\%$ of its value at the start of the year. The value at the end of the year is thus 0.68 of the value at the start.

The value at the end of the first year is 900×0.68 .

At the end of the second year, the value is $900 \times 0.68 \times 0.68 = 900 \times 0.68^2$.

Continuing this pattern, at the end of year 3, the value is thus 900×0.68^3 , which equals 282.9888.

To the nearest £100 this is £300.

See Unit 13, Subsection 1.2.

Solution 4Correct answer :

The value of the guitar increases by 2.8% each year, so at the end of a year its value is $1 + \frac{2.8}{100} = 1.028$ multiplied by its value at the start of the year.

So, the value at the end of the first year is 1200×1.028 .

At the end of the second year, the value is $1200 \times 1.028 \times 1.028 = 1200 \times 1.028^2$.

At the end of the third year, the value is $1200 \times 1.028^2 \times 1.028 = 1200 \times 1.028^3$.

At the end of year 10, the value is thus 1200×1.028^{10} , which to the nearest £1 is £1582.

We require the amount of increase, which is $£1582 - £1200$, i.e., £382.

See Unit 13, Subsection 1.2.

Solution 5Correct answer :

The investment increases by 6.2% each year, so at the end of a year its value is $1 + \frac{6.2}{100} = 1.062$ multiplied by its value at the start of the year.

Suppose the initial investment was £ i .

At the end of the first year it would be worth $i \times 1.062$.

At the end of the second year, the value would be $i \times 1.062 \times 1.062 = i \times 1.062^2$.

Following this pattern, at the end of year 12, the value would thus be $i \times 1.062^{12}$. We need this to be equal to £25000.

So, $i \times 1.062^{12} = 25000$ or, dividing both sides by 1.062^{12} ,

$$i = \frac{25000}{1.062^{12}} = 12146.35046$$

So, to the nearest £1, the amount to be invested is £12146.

See Unit 13, Subsection 1.2.

Solution 6Correct option for box 1: Correct option for box 2: Correct option for box 3:

The correct answer is

A function of the form $y = b^x$ is called **exponential**. Such functions can be either discrete or **continuous**. While graphs of continuous exponential functions are smooth in shape, if the data from the chessboard problem of Unit 13, Subsection 1.1, where the number of grains of rice is doubled for each square on the chessboard, were plotted, the shape of the exponential graph would be a series of **unconnected** points.

See Unit 11, Subsection 1.3.

Solution 7Correct answer :

The interest rate of 1.5%, each month corresponds to a monthly scale factor of 1.015.

This is applied twelve times a year, so the yearly scale factor is $1.015^{12} = 1.19562$.

Practice quizzes for Units 11 to 14 (Set 2)

This corresponds to a yearly interest rate of 19.56% (to two decimal places), so the APR is 19.56%.

See Unit 13, Subsection 2.2.

Solution 8

Correct option :

The correct option is:

- Setting $a = 1$, $b = 2$ gives a graph with the line $y = c$ as an asymptote. This is because these settings give the equation $y = 2^x + c$ which indeed has $y = c$ as an asymptote.

The remaining options were incorrect:

- Setting $b = 0$ gives a horizontal straight line $y = a + c$. This is incorrect since setting $b = 0$ would mean $b^x = 0$ giving the line $y = c$.
- It is possible to find values for a and b which would turn the equation into a quadratic equation. This is not true. A quadratic equation needs to have a term in x^2 , but no values of a and b can produce this term.
- Setting $c = 0$ gives a horizontal straight line $y = ab$. This is incorrect since setting $c = 0$ would leave $y = ab^x$.
- Setting $a = 0$, $b = 0$ and $c = 0$ causes the equation and its graph to disappear. These settings give the equation $y = 0$, which is the equation of the x axis.

See Unit 13, Section 3.

Solution 9

Correct option :

The number 18.94 lies between 10 (i.e. 10^1) and 100 (i.e. 10^2).

The logarithm (to base 10) of 18.94 thus lies between 1 and 2.

See Unit 13, Subsection 4.2.

Solution 10

Correct answer :

The number 81 can be written as 3^4 , to the logarithm to base 3 of 81 is 4.

See Unit 13, Subsection 4.4.

Solution 11

Correct answer :

Using the rule for the logarithm of a power of a number, $\log_b x^n = n \log_b x$, we can write

$$4 \log_3 6 - 3 \log_3 3 + 2 \log_3 5 = \log_3 6^4 - \log_3 3^3 + \log_3 5^2.$$

The rules for the addition and subtraction of logarithms, $\log_b x + \log_b y = \log_b(xy)$ and $\log_b x - \log_b y = \log_b(\frac{x}{y})$, then allow us to write

$$\log_3 6^4 - \log_3 3^3 + \log_3 5^2 = \log_3 \left(\frac{6^4 5^2}{3^3} \right).$$

So $x = \frac{6^4 5^2}{3^3}$, or simply 1200.

See Unit 13, Subsection 5.1.

Solution 12Correct answer : 1.49The equation to solve is $5^x = 11$.Taking logs to base 10 of both sides: $\log_{10}(5^x) = \log_{10}(11)$.Using the fact that $\log_b(x^n) = n \log_b x$, we can write $\log_{10}(5^x) = x \log_{10}(5)$, so the equation becomes

$$x \log_{10}(5) = \log_{10}(11).$$

Hence, dividing both sides by $\log_{10}(5)$: $x = \frac{\log_{10}(11)}{\log_{10}(5)} = 1.489896102$.

Rounding to two decimal places gives 1.49.

See Unit 13, Subsection 5.2

Solution 13Correct answer : 119.2

If level of radioactivity reduces by 0.58% each day, then the scale factor is

$$\frac{100-0.58}{100} = 1 - \frac{0.58}{100} = 0.9942.$$

So, at the end of each day the level of radioactivity is 0.9942 of that at the start of the day.

At the end of the first day, the level of radioactivity will be 0.9942 of the current level.

At the end of the second day, the level of radioactivity will be 0.9942^2 of the current level.At the end of the third day, the level of radioactivity will be 0.9942^3 of the current level.Following this pattern, at the end of day t , the level of radioactivity will be 0.9942^t of the current level.

We need to find the time taken for the level of radioactivity to halve, so we need to solve

$$0.9942^t = \frac{1}{2}$$

Taking logs to base 10 of both sides gives

$$\log_{10}(0.9942^t) = \log_{10}\left(\frac{1}{2}\right).$$

Using the fact that $\log_b(x^n) = n \log_b x$, we can write $\log_{10}(0.9942^t) = t \log_{10}(0.9942)$, so the equation becomes

$$t \log_{10}(0.9942) = \log_{10}\left(\frac{1}{2}\right).$$

Hence, dividing both sides by $\log_{10}(0.9942)$:

$$t = \frac{\log_{10}\left(\frac{1}{2}\right)}{\log_{10}(0.9942)} = 119.1612250.$$

Rounding to one decimal place gives 119.2 days.

See Unit 13, Subsection 5.3

Solution 14Correct answer : 4If the level of radioactivity reduced by a scale factor of s every minute, then the half-life, i is given by

$$s^i = 0.5.$$

In this case we are given that $i = 57$, so $s^{57} = 0.5$.

Practice quizzes for Units 11 to 14 (Set 2)

This can be solved to find the scale factor, s . Taking the 57th root of both sides gives

$$s = \sqrt[57]{0.5}, \text{ which can also be written as } s = 0.5^{\frac{1}{57}}.$$

Evaluating this gives the scale factor, $s = 0.9879131629$.

If level of radioactivity reduces by this each minute.

Initially, the level is 12 becquerels.

After the first minute, the level of radioactivity will be 12×0.9879131629 .

After the second minute, the level of radioactivity will be 12×0.9879131629^2 .

So, after 100 minutes, the level of radioactivity will be
 $12 \times 0.9879131629^{100} = 3.556791804$.

To the nearest becquerel, this is 4 becquerels.

See Unit 13, Subsection 5.3

Unit 14 practice quiz solutions

Solution 1

Correct answer :

The chance is '1 in 13', that is $1/13 = 0.077$ to two significant figures.

See Unit 14, Subsection 1.1.

Solution 2

Correct option :

Correct option :

Equating the expressions for y gives:

$$5x + 10 = x^2 - 10x - 6$$

Rearrange:

$$0 = x^2 - 15x - 16$$

Factorise:

$$0 = (x + 1)(x - 16)$$

Hence $x = -1$ or $x = 16$.

To find the corresponding y values substitute these values of x into the first equation.

When $x = -1$,

$$y = 5 \times (-1) + 10 = 5.$$

When $x = 16$,

$$y = 5 \times 16 + 10 = 90.$$

So the two solutions for y are 5 and 90.

See Unit 14, Subsection 2.1.

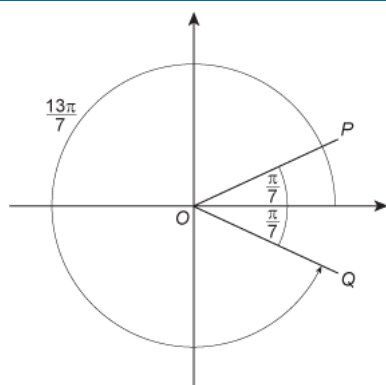
Solution 3

Correct option :

The angle $\frac{13\pi}{7}$ lies in the fourth quadrant.

So the cosine is positive and the required angle lies in the first quadrant.

Now draw a diagram to determine the related angles.



In the diagram the angle between the positive horizontal axis and OP is $\frac{13\pi}{7}$.

The angle with the same cosine is the angle to the line OQ , where Q lies on a vertical line with P .

The related angle in the first quadrant is $\frac{\pi}{7}$, and this is the required answer.

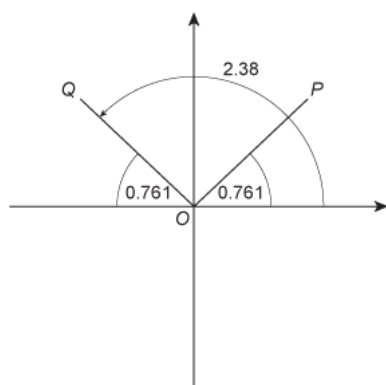
See Unit 14, Subsections 2.2 and 2.4.

Solution 4

Correct answer : 2.38

The sine of θ is positive, so θ lies in the first and second quadrants.

The related acute angle is given by $\sin^{-1}(0.69) = 0.761 \dots$



So from the related angles diagram, the two angles are 0.761 and $\pi - 0.761 = 2.38$ (to three significant figures).

The answer is the larger of these two solutions: 2.38.

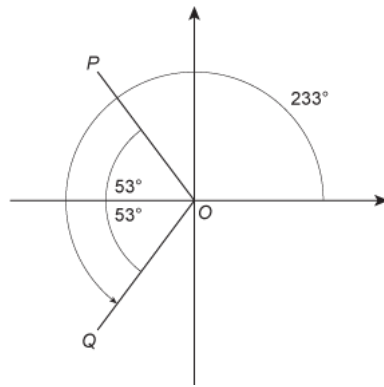
See Unit 14, Subsections 2.2, 2.4 and 2.5.

Solution 5

Correct answer : 233

The cosine of θ is negative, so θ lies in the second and third quadrants.

The related acute angle is given by $\cos^{-1}(0.596)$, which is 53° to the nearest degree.



So from the related angles diagram, the two angles are $180^\circ - 53^\circ = 127^\circ$ and $180^\circ + 53^\circ = 233^\circ$.

So the larger angle is 233° and the answer is 233.

See Unit 14, Subsection 2.2.

Solution 6

Correct answer :

The gradient of the line is $6/7$.

So, if θ is the angle of inclination, then $\tan \theta = 6/7$.

By definition the angle of inclination, θ , lies between 0° and 180° .

Since $\tan \theta$ is positive then we expect θ to be acute.

Performing the calculation gives $\tan^{-1}(6/7) = 41^\circ$ (to the nearest degree), which is indeed acute.

Hence the angle of inclination is 41° and the answer is 41.

See Unit 14, Subsection 2.3.

Solution 7

Correct option :

For the general sine function $y = a \sin(b(x - c)) + d$ the period is given by $\frac{2\pi}{|b|}$.

For the given function $b = 8$, so the period is

$$\frac{2\pi}{|8|} = \frac{\pi}{4}.$$

So the answer is $\frac{\pi}{4}$.

See Unit 14, Subsection 4.2.

Solution 8

Correct option :

Correct option :

Practice quizzes for Units 11 to 14 (Set 2)

The general sine function $y = a \sin(b(x - c)) + d$ where $a > 0$, has the following properties:

- the amplitude is given by a ;
- c is the horizontal displacement;
- d is the vertical displacement;
- the period is given by $\frac{2\pi}{|b|}$.

The function

$$y = 7 \sin\left(5x + \frac{\pi}{3}\right) - 5$$

can be rearranged as

$$y = 7 \sin\left(5\left(x + \frac{\pi}{15}\right)\right) - 5,$$

so $a = 7$, $b = 5$, $c = \frac{\pi}{15}$ and $d = -5$.

Hence the amplitude is 7, the horizontal displacement is $\frac{\pi}{15}$ units to the left, and the vertical displacement is -5 .

The minimum value is given by $d - a = -5 - 7 = -12$.

So the correct options are:

- The graph of $y = 7 \sin\left(5x + \frac{\pi}{3}\right) - 5$ can be obtained by shifting the graph of $y = 7 \sin(5x) - 5$ by $\frac{\pi}{15}$ units to the left.
- The minimum value of the function is -12 .

See Unit 14, Subsection 4.2.